Stability of Total Phenolics and Anthocyanins of Three Types of Black Raspberry Confections During Storage

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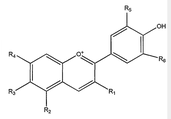
Background

- Phenolic compounds, such as anthocyanins, proanthocyanidins and ellagitanins, are recognized as the major components in black raspberries that have been linked to the chronic disease prevention.
- Anthocyanin compounds are the common pigment in berries that give the berries blue to black colors based on the compositions and concentration[1].The anthocyanins in berries are related to the prevention of chronic disease, such as heart disease, cancer and obesity[1].



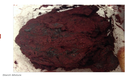
- However, during long-term storage, the anthocyanins undergo the polymerization reactions[1] to form colored polymeric compounds.[2] The polymeric pigments have influence on the color and health-promotion ability related to anthocyanins and procyanidins.[1]

Objective

The **objective** of this study was to determine the influence of storage temperature (4 ºC and 25 ºC) and storage time (two months) on the total phenolics, anthocyanins and percent polymeric color of three types of black raspberries confections: pectin gummy, starch gummy and hard candy.

Materials and Methods

Confection Preparation



Freeze-dried
Black raspberry powder

Pectin gummy
25% BRB powder

Starch gummy
40% BRB powder

Hard candy
21% BRB powder

*Citric acid was added in Pectin gummy.

- Each type of confections were prepared for three batches with the same freeze-dried black raspberry powder.
- Samples were stored at 4 ºC and 25ºC and phenolic compounds were measured during storage (fresh, 2, 4 6 and 8 weeks).

- Confections were cut and measured with different weight to make sure the amount of black raspberry powder is the same
- Measured confections were dissolved in 5% formic acid water
- Three different protocols were applied to the target compounds

765 nm → **Concentration of Total Phenolics**

512.5nm
700 nm → **Concentration of Anthocyanin**

$\lambda_{vis\text{-}max}$=512.5nm
420 nm → **Concentration of Percent of Polymeric color**

Total Phenolics & Anthocyanins Measurements:

- Total Phenlics - **Folin-ciocalteu Colorimetry**[3]

Phenolic compounds + Redox reagent → Blue color that can be qualified with a maximum at 765 nm

➢ Gallic acid(with concentration of 50,100, 250 and 500mg/L) served as calibration standards

- Anthocyanin **- pH-differential method**[4]

Anthocyanin → pH=1.0 → Form oxonium: colored
Anthocyanin → pH=4.5 → Form hemiketel: colorless

- Percent polymeric color **– bisulfite**[4]

Polymeric color(PC), Mono-anthocyanin(MA) → Sodium Bisulfite → PC: resisted to bisulfite and remain red color; MA: form anthocyanin-sulfonic acid adducts

Results

1. Total Phenolics during storage

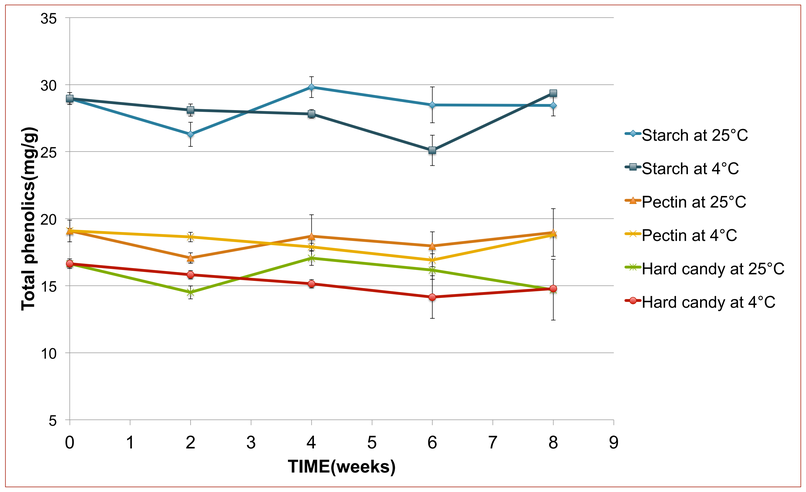


Figure 1. Concentration of total phenolics in three types of confections during two-month storage.

2. Anthocyanins During Storage

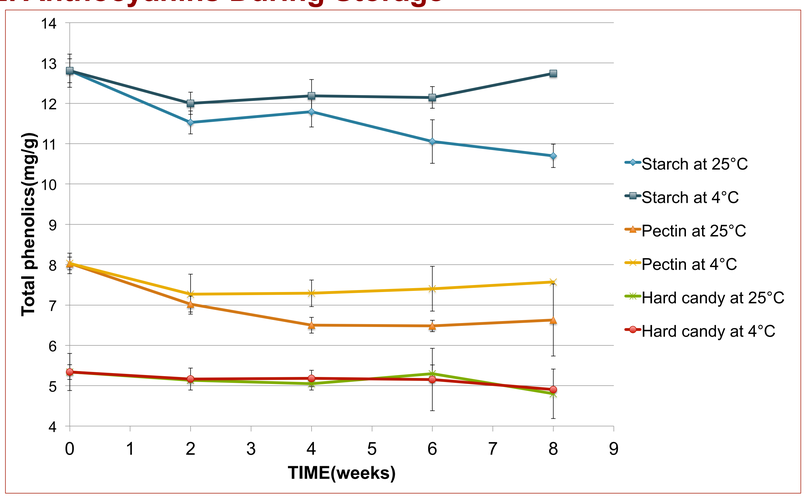


Figure 2. Concentration of anthocyanins in three types of confections during two-month storage.

3. Polymeric Anthocyanins During Storage

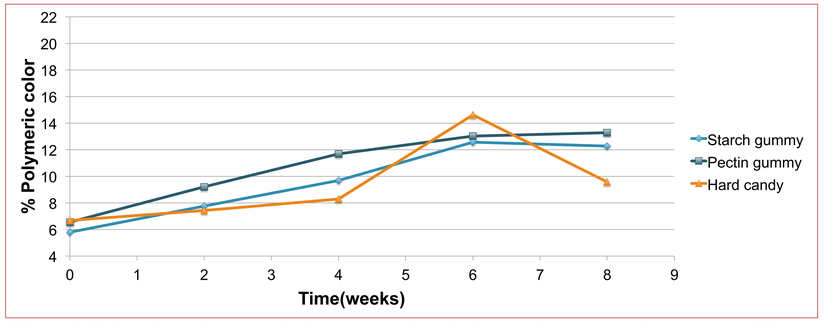


Figure 3. Polymeric anthocyanins in three types of confections during two-month storage at 4 ºC.

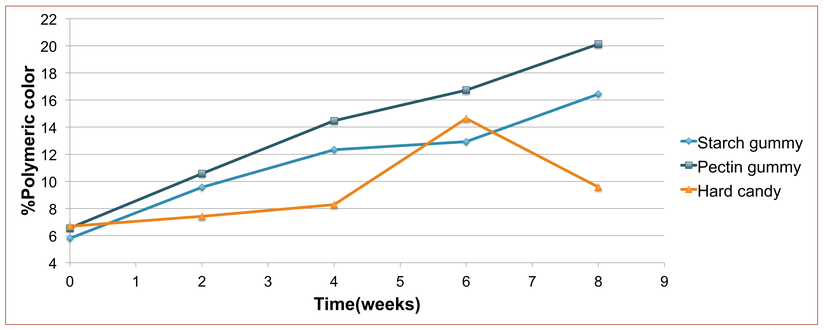


Figure 4. Polymeric anthocyanins in three types of confections during two-month storage at 25 ºC.

Conclusions

- Total phenolics were relatively stable through the two-month storage at both 4 ºC and 25 ºin pectin gummy and hard candy.
- Anthocyanins decreased during the first two-week storage and remained stable through the whole storage period at both temperature, except starch gummy stored at 25 ºC, which have significant decrease after six week storage.
- Polymeric colors of all confections stored at room temperature increased during storage, while that confections stored at 4ºC were more stable
- Phenolic compounds had the highest stability at 4 ºC in pectin and hard candy confections during the two-month storage, while the starch gummy remained the highest concentration of total phenolics and anthocyanins

Reference

[1] Howard L.R, Prior R.L, Liyanage R and Lay J.O. 2012. Processing and Storage Effect on Berry Polyphenols: Challenges and Implication for Bioactive Properties. J Agr Food Chem 60: 6678-93.

[2] Kadivec M, Bornsek S.M, Polak T, Demsar L, Hribar J and Pozrl T. 2013. Phenolic Content of Strawberry Spreads during processing and Storage. J Agr Food Chem 61: 9220-9.

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[4] Giusti M.M and Wrolstad R.E. 2001. Characterization and Measurement of Anthocyanins by UV-Visible Spectroscopy. In Worlstad R.E, editor. Current Protocols in Food Analytical Chemistry. New Jersey: John Wiley & Sons. F1.2.1-1.2.13

Acknowledgements

Thanks to Dr. Vodovotz, Junnan Gu and Jennifer Ahn-Jarvis for being great advisors and the Department of Food Science and Technology for opportunity to participate in research project.

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